

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
NATIONAL TECHNICAL UNIVERSITY
“KHARKIV POLYTECHNIC INSTITUTE”

**GUIDELINES FOR INDIVIDUAL ASSIGNMENTS
ON DISCIPLINE “COMPUTER NETWORKS”**

for students specialty 121 “Software Engineering”

**МЕТОДИЧНІ ВКАЗІВКИ ДО ВИКОНАННЯ КУРСОВОЇ РОБОТИ
З КУРСУ «ОРГАНІЗАЦІЯ КОМП'ЮТЕРНИХ МЕРЕЖ»**

для студентів спеціальності 121 «Інженерія програмного забезпечення»

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GUIDELINES FOR INDIVIDUAL ASSIGNMENTS ON DISCIPLINE
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Compilers: O.V. Shmatko,
I.O. Borodina

Reviewer V.Yu. Volovshchykov

Software Engineering and Management Information Technologies Department

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INTRODUCTION

Students are required to produce a term project building upon and complementing the material covered in class. The topic of the project should be related to making Ethernet cable, Network design, network security. A set of suggested projects is attached below. Each of you is required to pair up with another student to form a team of two members for the project.

The final result of the project will be a technical report and a presentation.

Students participate in computer networking courses during third course. Computer networking projects give students hands-on experience to learn and digest the course materials being taught. These course project also give students practical experience, especially for those who plan to continue their careers within the field.

1 GENERAL GUIDELINES

Grading of written reports and presentations will be based upon substantive content, appropriate organization and use of allotted report size or presentation time, and effectiveness of the presentation or report. Make clear what is the problem you have studied, why is it important and difficult, and what is your key idea and approach. Observe and explain the experimental results. Take the time to properly cite material written by someone else – include references, put verbatim quotes in quotation marks, and do not paraphrase excessively.

The project consists of several steps described below.

Step 0: Find a partner (before 7/04)

You should fix your partner before 7/04/2015. Send an email to instructor if you have difficulty in finding a partner. Instructor will try to pair you up with another student.

Step 1: Proposal (due 14/04)

1.1 A set of project topics prepared by instructor is attached as-is (some of the topics may not be covered in this class, but it is fine to work on them). You may select one, or you may devise your own comparable project. You may need to read some relevant chapters in the textbook. All projects must be approved by the instructor.

1.2 Each team needs to meet with the instructor to discuss the proposed project before writing the proposal. You can drop by in the office hour, or you can send an email to the instructor (asu.spios@gmail.com) to schedule an appointment. You should have well studied the problem and have some ideas about the project before meeting the instructor.

Submit the proposal to the instructor before Apr 14. It is encouraged to submit the proposal early. The earlier you finish your proposal, the more time you have to implement your project.

Step 2: Implementation

In this phase, you and your partner implement the project. Make a feasible progress schedule and follow it. Team members should divide the work evenly and closely collaborate with each other. You are expected to finish most of the

work by 29/04. However, you can keep working on the project until the submission of the technical report in Step 4.

Step 3: Presentation (11/05–15/05)

Each team will give a 10 minute presentation in class, with time for questions and discussion. Presentations should be self-contained, and should be clear and precise. Briefly introduce the topic including any background information, describe the investigation, development, or experimentation that was conducted, and provide any demonstrations developed as part of the project, or describe the results of the investigation or experimentation. The following format is suggested:

- (1) Title. Name the project and all the team members.
- (2) Outline. Summarize the full presentation.
- (3) Introduction. Introduce the purpose and goals of the project. Provide any background material necessary to understand the presentation.
- (4) Investigation, development, or experimentation conducted. Describe the actual work performed during the project.
- (5) Results. Show any demonstrations developed or results achieved during the project.
- (6) Conclusion.
- (7) Questions and discussion.

Step 4: Technical report (due 20/05)

Each course project will result in a detailed 10-20 page written technical report. The project report should be a self-contained scientific report with a conference-paper quality. Also, it should be written with the readers in mind. Any class member should be able to understand your report, and benefit from the results you obtain. Therefore, you should include adequate references and/or background materials and you should use tables, diagrams, graphs, figures, and portions of printouts to enhance readers' comprehension of your project.

The following format is suggested. You don't have to follow it exactly. Some sections may not be needed, or additional sections may be necessary.

- (1) Abstract. Gives succinct information on the purpose, methods, results and conclusions reported.

(2) Introduction. Include background material and discuss the scope and limitations of your project.

(3) Technical details. The body of your report. This includes the methodology used. Be sure to fully describe any figures, tables or diagrams you include.

(4) Experimental results.

(5) Related work. Discussion and comparison.

(6) Conclusions.

(7) Recommendations, especially for future work and unsolved problems.

(8) References (must always be included), annotated if possible.

Important Dates

Form a team: Apr 7

Proposals due: Apr 14

Project presentations: May 11 – May 15

Final report and software due: May 20

2 PROJECTS MANUAL

2.1 Research Projects

Here are some ideas for research project topics.

2.1.1 Network Design

Network design projects allow students to use their creativity when working with computer networks. With these projects, the instructor hands out a list of scenarios that require them to design a computer network. Scenarios could include a business office that needs to setup a LAN, a bank with a branch office that needs Internet connection and the set-up of a wide area network (WAN) or a city that wants to implement a metropolitan area network (MAN) for its residents. Students design the network and make a presentation out of the design, explaining the hardware (i.e. servers, VPN routers, workstations), connection methods (i.e. Ethernet, fiber-optic, etc) and software needed to set up and manage the computer network. Students can use free network diagram programs such as SmartDraw, Gliffy and Edraw Soft to make a graphical representations of networks.

2.1.2 Network Security

A computer networking project which students can take on involves network security. In this type of project, instructors hand out scenarios to groups of students of already-designed computer networks. Students review the network design and look for both internal and external "holes" in security, which leaves the network vulnerable to intruders and outsiders. The groups of students use presentation and network diagram software tools to map out and explain additional steps that need to be taken to improve security – both internal and external – on the network. Solutions for improving network security may include adding firewall devices, implementing and configuring network management software and changing network infrastructure and connection methods.

2.1.3 Networking Projects

This part promotes project tasks on networking projects, network security projects, network design projects, network programming projects, ethical hacking

projects and projects in computer network and security protocol analysis and testing. The part also contains different topics in networking and network security topics which can be used for research project:

- 1 Small Business Network Design with secure e-commerce server
- 2 Employee Website Monitoring using Packet Analysis
- 3 DHCP Infrastructure security threats , mitigation and assessment
- 4 Network Security Policy Implementation for Campus
- 5 Comparative study of web application and network layer firewalls
- 6 Hospital Network Design
- 7 Small business network design with guest network
- 8 Network Intrusion detection based on pattern matching
- 9 Network Security Design Proposal for Small Office
- 10 IP CCTV Network Design for Enterprise
- 11 Packet Loss Testing tool
- 12 Network design proposal for bank
- 13 Remote Access VPN design behind NAT router
- 14 Hotspot design proposal for coffee shop
- 15 Network design proposal for LAN

2.2 Technical projects

The networking projects which are listed on this part are professional projects in networking, which would be encountered in a real world environment. This part contains categories, which are meant for different types of Computer networking careers.

2.2.1 Variant 1. Configure RIP on the corporate network

Create a diagram in figure 2.1.

Questions.

1. Set up the corporate network using the protocol RIP.
2. Check the connection between the computers Comp1 and Comp3 using ping and tracert on and off at the router #5.
3. Check the connection between computers PC0 and Comp1 using ping and tracert on and off at the router #2.

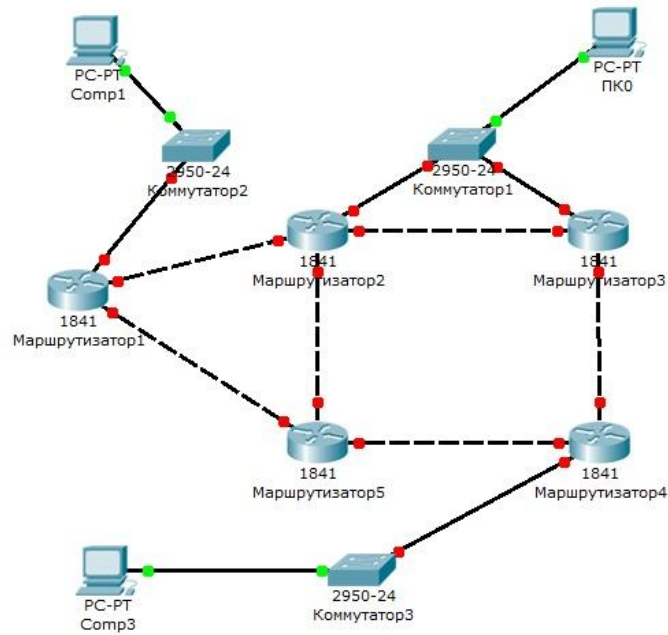


Figure 2.1 – Scheme network for variant 1

2.2.2 Variant 2. ACLs ACL (Access Control List)

The enterprise has two divisions, the circuit networks which is shown in figure 2.2.

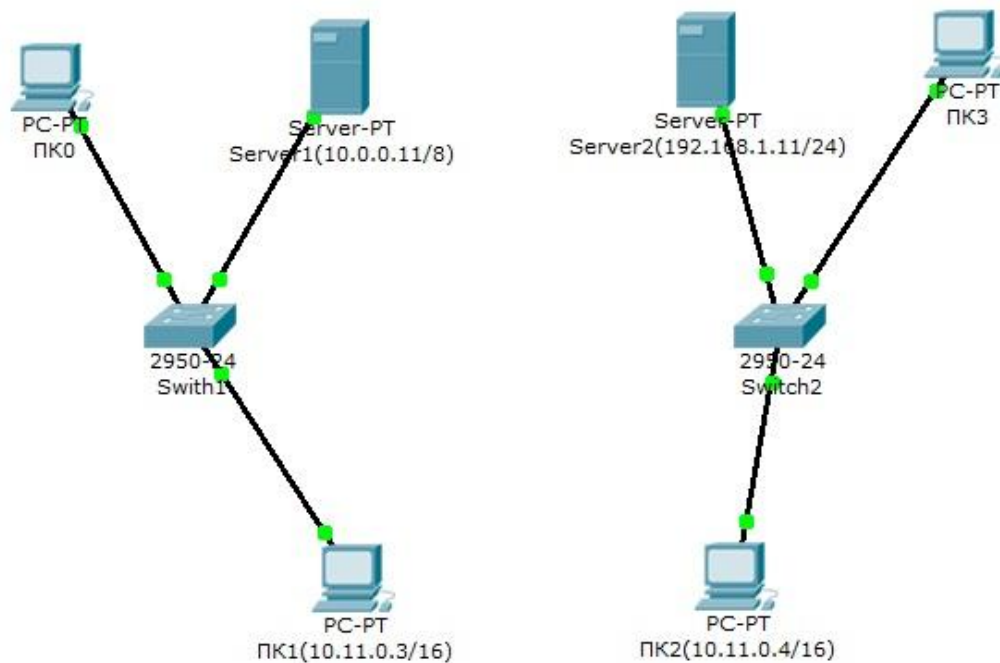


Figure 2.2 – Scheme network for variant 2

Scheme networks departments of the enterprise.

Division 1 – Switch1, Division 2 – Switch2.

Each network has a server with DHCP, DNS, and HTTP (on Server1 and Server2 are situated websites departments).

Computers PC0 and PC3 with the DHCP server of their networks get the IP address and gateway.

Computer PC1 and PC2 are in the same private network VLAN.

Questions:

Complete the circuit network router or switch in the third level, to ensure that the corporate network operation in the following modes:

- 1) computers PC0 and PC3 have to open each of the sites;
- 2) computers PC1 and PC2 should be available only for each other.

2.2.3 Variant 3. ACLs ACL (Access Control List)

Create a network shown in figure 2.3.

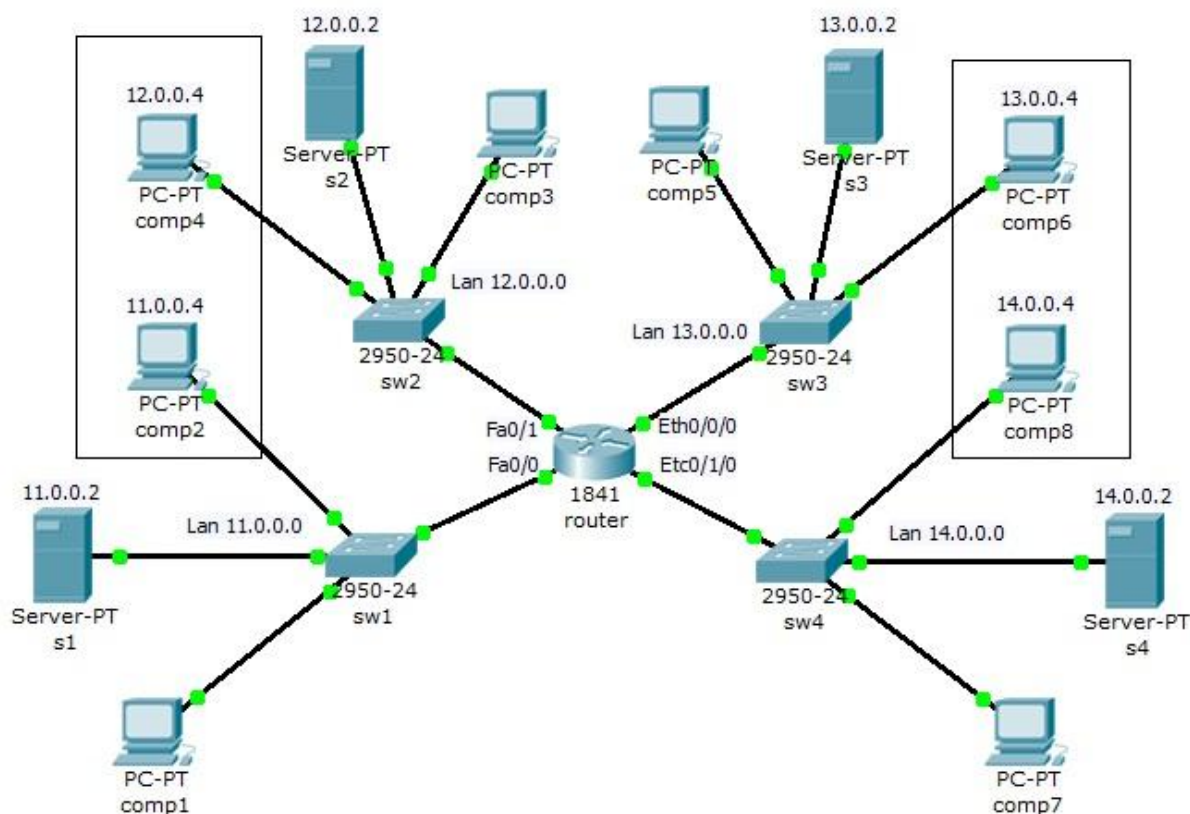


Figure 2.3 – Scheme network for variant 3

The scheme of the corporate network.

Corporate network consists of four networks:

Network 1 – 11.0.0.0/8;

Network 2 – 12.0.0.0/8;

Network 3 – 13.0.0.0/8;

Network 4 – 14.0.0.0/8.

In each network installed on the server Web site.

Questions:

1 Computer comp2 only available computers and their networks somp4.

2 Computer comp4 only available computers and their networks somp2.

3 Computer comp8 only available computers and their networks somp6.

4 Computer comp6 only available computers and their networks somp8.

5 Computers comp1, comp3, comp5 and comp7 must open all the sites on servers S1, S2, S3 and S4.

2.2.4 Variant 4. ACLs ACL (Access Control List)

Create a network shown in figure 2.4.

Diagram corporate network.

Corporate network consists of four networks:

Network 1 – 11.0.0.0/8;

Network 2 – 12.0.0.0/8;

Network 3 – 13.0.0.0/8;

Network 4 – 14.0.0.0/8.

In each network installed on the server Web site.

Questions:

1 Network 14.0.0.0 is not available from the network 11.0.0.0.

2 Computers and comp1 comp2 allow discovery site on server3, but prohibit listening server3 command ping.

3 Computers comp1 allow access to server2, but prevent users from opening a site on this server.

4 Computers comp2 allow access to server1, but prevent users from opening a site on server1, to allow access to the site and opening server4.

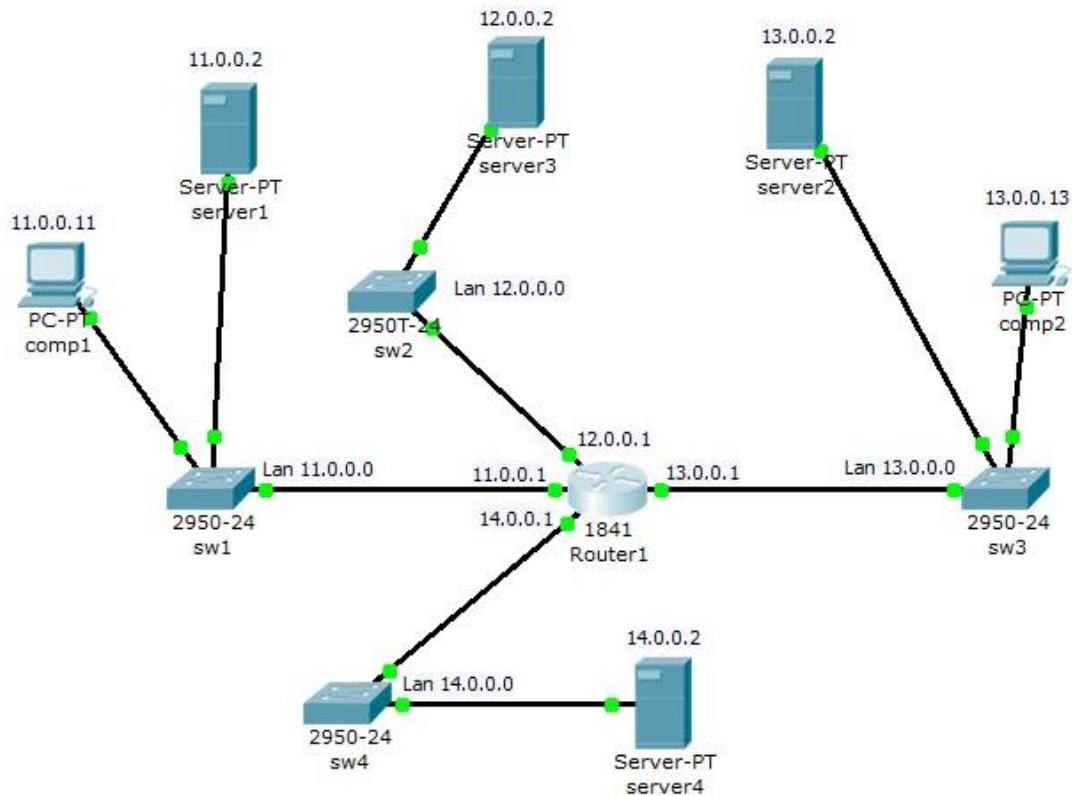


Figure 2.4 – Scheme network for variant 4

2.2.5 Variant 5. ACLs ACL (Access Control List)

Create network diagram shown in figure 2.5. Set addressing network and arbitrarily.

The scheme of the corporate network.

Questions:

1 Computers comp1, comp2 comp3 and are in the same VLAN 10 are available only for each other and have access to server1.

2 Computers comp4, comp5 comp6 and are in the same VLAN 20 are available only for each other and have access to server1.

3 Computers and comp7 comp8 available only for each other and have access to server1.

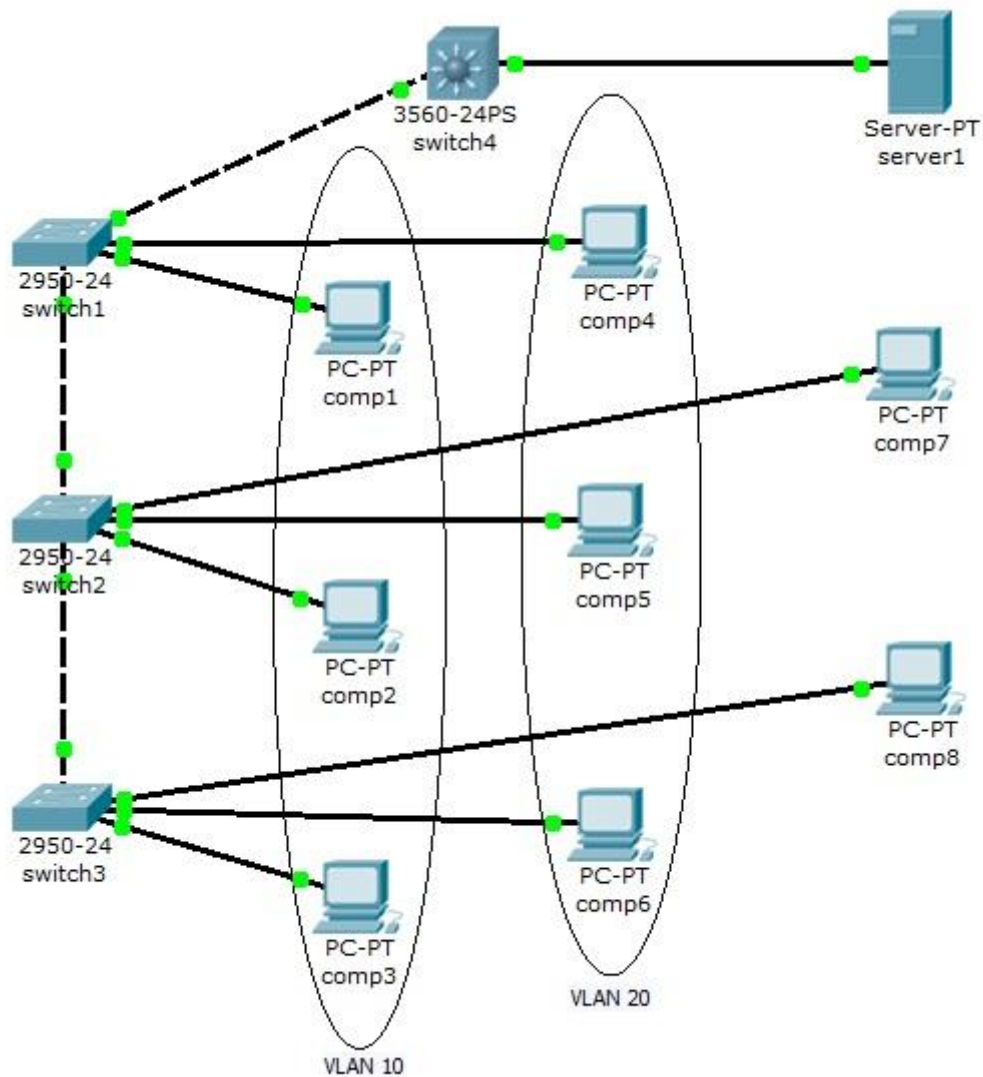


Figure 2.5 – Scheme network for variant 5

2.2.6 Variant 6. ACLs ACL (Access Control List)

Create network diagram shown in figure 2.6.

The scheme of the corporate network.

Questions:

On all three servers installed Web services and FTP.

Create access lists to let your computer and comp1 comp2 following access rules in the network:

Computer comp1:

Server1 – allow access to the FTP;

Server2 – allow access to the Web;

Server3 – allow access to the Web and FTP.

Computer comp2:

Server1 – allow access to the Web;

Server2 – allow access to the FTP;

Server3 – allow access to the Web and FTP.

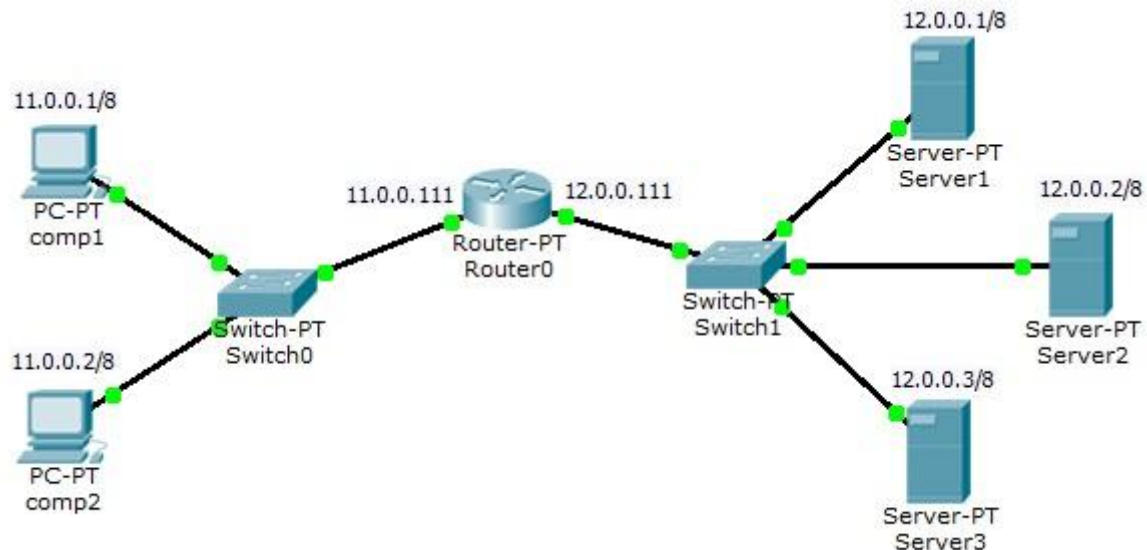


Figure 2.6 – Scheme network for variant 6

2.2.7 Variant 7. ACLs ACL (Access Control List)

Create network diagram shown in figure 2.7.

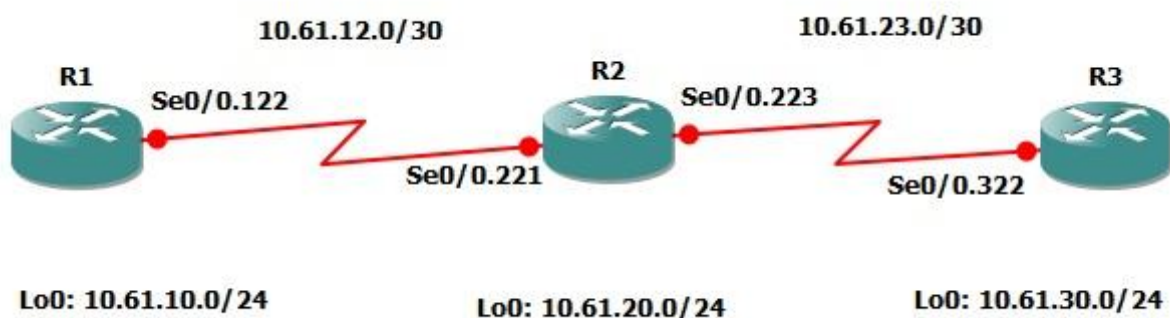


Figure 2.7 – Scheme network for variant 7

Questions:

1 Create a Static Route on R1 that states to get to 10.61.20.0/24 go to the next hop of 10.61.12.2 then place the return route on R2 stating to get to 10.61.10.0/24 go to the next hop of 10.61.12.1. Verify that the routes added operate correctly by pinging R2's Lo0 interface sourced from R1's Lo0 interface.

2 Create a Static Route on R2 that states to get to 10.61.30.0/24 go to the next hop of 10.61.23.2 then place the return route on R3 stating to get to 10.61.20.0/24 go to the next hop of 10.61.23.1. Verify that the routes added operate correctly by pinging R3's Lo0 interface sourced from R2's Lo0 interface.

3 Configure R1 to route 10.61.30.0/24 to the next hop of 10.61.12.2 (R2) then configure R3 to route 10.61.10.0/24 to 10.61.23.1. Afterward verify that you have IP communication between 10.61.10.0/24 and 10.61.30/24

3 REQUIREMENTS FOR THE REPORT

Report on individual assignments is available in printed form and must be signed by the student.

3.1 Structure of the report

The report shall contain:

Cover page designed in accordance with the requirements for registration (Annex B).

Individual work (sample clearance Appendix D).

- 1 Introduction.
- 2 The practical part (Referred to as according selected Topics).
- 3 Conclusion.
- 4 List of references.
- 5 Applications.

3.2 Requirements for the report

Requirements for registration of the text.

Report on individual tasks performed on the computer in a single copy and is issued only on the front side of the white paper.

- standard paper size A4 (210 x 297 mm);
- field: left – 30 mm, the upper – 20 mm, right – 10 mm, bottom – 20 mm;
- orientation: portrait;
- font: Times New Roman;
- pins: 14 pt (points) in mainly text, 12 pt in footnotes;
- line spacing: 1,5 in the main text, a single subscript references;
- hyphenation: automatic;
- basic text formatting and links – in the parameter “in width”;
- fontcolor: black;
- redline: 1.5 cm.

Volume of the report on an individual assignment.

The number of pages is determined by calculating: introduction – up to 3 pages, the practical part of 15-20 pages, opinion pages 1-2.

In this volume does not cover: a list of sources used and the application.

All pages are filled with text, which highlighted paragraphs. Each new chapter and the introduction, conclusion, list of sources used and the application starts on a new page.

Requirements for pagination:

– sequentially from the third page (introduction), t.e. after the title page, table of contents and tasks of work, as well as a list of abbreviations used in the work (if it exists in the work);

– further consecutive numbering of all sheets, including chapters, conclusion, list of sources used and the application (if available in work);

– page numbering, which are applications that is and continues through unnumbered pages of text;

– a page number is located in the lower right corner.

Requirements titles:

– typed in bold (font 14 pt.);

– centered;

– point at the end of the header is not put;

– header consisting of two or more lines printed in one line spacing;

– header has no hyphenation, ie at the end of the string word must necessarily be complete.

Requirements for registration tables, charts, drawings:

– name placed under the table to the left, with no indentation in one line with its number by a dash;

– at the end of headings and sub-tables are not put points;

– when transferring the title of the table is placed only on the first part of the table, the lower horizontal line bounding the table, do not spend;

– when borrowing tables from any source, after it issued a footnote to the source in accordance with the requirements for registration of footnotes;

- tables, diagrams and drawings occupying page and more placed in application, and small – in the pages of the report;
- scheme and pattern are signed lower center.

Requirements for registration of equations and formulas:

- stand out from the text on a separate line;
- above and below each formula or equation should be left at least one free string;
- if the equation does not fit on one line, it should be moved after the equal sign (=), or after the plus sign (+), minus (-), multiplication (x), division (:), or other mathematical signs, and sign in early next lines repeat;
- when transferring the formula on the sign, symbolizing the multiplication operation is used mark (X);
- formulas and equations that are placed in the applications numbered separately numbered in Arabic numerals within each application before adding each digit designation applications, for example, (5.1);
- references in the text to the sequence numbers of the formulas given in parentheses, such as “in the formula (1)”;
- explanation of symbols and values of the numerical coefficients should lead directly under the formula in the same sequence in which they are given in the formula.

Requirements for registration of references and footnotes:

- when quoting or using any of the provisions of the other works give reference to the author and the source of whom borrowed material;
- if the work is quoted to confirm the provisions in question, in its text retains all the features of the document from which it was taken: spelling, punctuation, placement of paragraphs, bolding. Quote within the text enclosed in quotes. All quotations, and borrowed from various documents arguments or statistics confirm the bibliographic reference to the source;
- we use footnotes with continuous numbering throughout the work;
- with repeated references complete description of the source is given only for the first footnote. If multiple references to the same source provided on one

page work, footnotes substitute the word "Ibid" and the page number, to which reference;

- if the work in the use of certain provisions should be brought bibliographic references, these provisions are marked with superscript characters, footnotes. At the bottom of the page with the indentation leads the text of bibliographic references, separated from the main text short thin horizontal line on the left side;

- the order of the references on the application on the text of the course work is the same as the order of the references in the illustration.

Requirements for registration of the list of sources used (Appendix D):

- list of sources used is a list of the documents and sources that were used in writing a term paper;

- list of used sources of an include at least 10 items located in Alphabetical order of by sections.

Requirements for registration of the list of abbreviations:

- we use common text abbreviations or acronyms, such as operating systems, computers, etc.;

- if adopted in a special system of abbreviations of words or names, that before the introduction is a list of abbreviations used in the work, which is not numbered.

Requirements for registration of the list of common terms.

If in the specific terminology adopted, at the end of work (before the list of sources used) placed compendium of terms with explanation.

Requirements for registration of applications:

- material, supplementing the text of the work is allowed to put in appendixes. Appendix may be graphic material, large-format tables, calculations, descriptions of algorithms and software problems solved on a computer, etc.;

- appendixes are used only if they complement the content of the main problems of the study and are provided for reference or recommendation;

- the nature of the appendix is defined by the author of the work yourself, based on the content;
- in the text of the appendix on all available links. The degree of the mandatory appendixes in referring not indicated;
- appendixes registered as a continuation of the work on the subsequent sheets of A4 or produced as a separate document. Appendixes arranged in order of reference in the text of report.
- each appendix starts on a new page with the indication in the upper right corner of the word “appendix” and is themed title;
- the presence in the work of more than one appendix, they should be numbered in Arabic numerals (unsigned №), such as “Appendix 1”, “Appendix 2” and so on.

APPENDIX A. EXAMPLE OF A TITLE PAGE

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

NATIONAL TECHNICAL UNIVERSITY

"KHARKIV POLYTECHNIC INSTITUTE"

Software Engineering and Management Information Technologies Department

Student Ivanov I. I.

Group KN-34g

TASK

for research and coursework

Course: «Computer Networks».

Summary of work:

a) Abstract of

Review of the literature on the aim of research project.

б) Theoretical part

Employee Website Monitoring using Packet Analysis.

в) Theoretical part

Configure RIP on the corporate network.

Date of assignment: 17.04.17

Duration of protection: 25.05.17

Instructor: _____ /ass. prof. Shmatko O. V. /

Figure A.1 – Task example

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
 NATIONAL TECHNICAL UNIVERSITY
 “KHARKIV POLYTECHNIC INSTITUTE”
 Software Engineering and Management Information Technologies Department

**COURSE PROJECT
 (WORK)**

in Computer Networks
 (discipline title)

on: Design and development of local area computer networks

Student 3 course KN-34g group
 direction 12 Information technologies

specialty 121 Software Engineering

Ivanov I. I.
 (surname, initials)

Instructor Phd, ass. prof. Shmatko O.V.
 (post, academic title, scholastic degree, surname and initials)

National mark _____
 Sum of points _____ ECTS mark _____

Commission members	_____	<u>Shmatko O. V.</u>
	(signature)	(surname, initials)
	_____	_____
	(signature)	(surname, initials)
	_____	_____
	(signature)	(surname, initials)

Kharkiv– 2016

Figure A.2 – Title page example

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE	
NATIONAL TECHNICAL UNIVERSITY	
"KHARKIV POLYTECHNIC INSTITUTE"	
Software Engineering and Management Information Technologies Department	
COURSE WORK	
Course "Computer Networks"	
Instructor:	
Ass. Prof.	Olexander V. Shmatko
Created:	
Student group KN-34g	Ivan I. Ivanov
Kharkiv-2016	

Figure A.3 – Title page example

РЕФЕРАТ

КР: 90 с., 22 рис., 12 табл., 54 джерела, 3 додатки

Ключові слова: РЕІНЖІНІРІНГ, РЕСТРУКТУРИЗАЦІЯ, БІЗНЕС-ПРОЦЕС, БІЗНЕС-СИСТЕМА, ІМІТАЦІЙНА МОДЕЛЬ, МЕРЕЖА ПЕТРІ

Об'єктом дослідження являється виробничий процес зборки регулятора напруги.

Метою роботи являється оптимізація трьох параметрів: часу зборки одного агрегату, якості зборки одного агрегату та доходу від виробничої діяльності.

На основі вивчення виробничого процесу було побудовано дві моделі: комп'ютерна імітаційна модель в системі програмування eMPlant, яка описує рух матеріалів в межах цехового простору та мережа Петрі призначена для перевірки функціонування першої моделі. На основі мережі Петрі були виявлені вузькі місця виробничого процесу. Було запропоновано заходи щодо змін технологічного маршруту та устаткування, що може забезпечити зменшення часу зборки на 20%.

На базі отриманих моделей побудовано WEB-орієнтоване програмне забезпечення, яке впроваджено на ВП «Комунар».

Figure A.4 – Abstract's example in Ukrainian

РЕФЕРАТ

КР: 90 с., 22 рис., 12 табл., 54 источника, 3 приложения

Ключевые слова: РЕИНЖИНИРИНГ, РЕСТРУКТУРИЗАЦИЯ, БИЗНЕС-ПРОЦЕСС, БИЗНЕС-СИСТЕМА, ИМИТАЦИОННАЯ МОДЕЛЬ, СЕТЬ ПЕТРИ

Объектом исследования является производственный процесс сборки регулятора напряжения.

Целью работы является оптимизация трех параметров: времени сборки одного агрегата, качества сборки одного агрегата и дохода от производственной деятельности.

На основе изучения производственного процесса построены две математические модели: компьютерная имитационная модель в системе программирования eMPlant, описывающая движение материалов в пределах цехового пространства и сеть Петри, предназначенная для проверки функционирования первой модели. На основе сети Петри были выявлены узкие места производственного процесса. Предложены мероприятия по изменению технологического маршрута и оборудования, которые могут обеспечить уменьшение времени сборки на 20%.

На основе полученных моделей разработано WEB-ориентированное программное обеспечение, которое внедрено на ПП «Коммунар».

Figure A.5 – Abstract's example in Russian

ABSTRACT

SW: 90 p., 22 fig., 12 tab., 54 sources, 3 appendixes

Keywords: REENGINEERING, RESTRUCTURING, BUSINESS PROCESS, BUSINESS SYSTEM, SIMULATION MODEL, PETRI NET

The object of research is production process of voltage regulator assembling.

The objective of the research is the optimization of three parameters: unit assembling duration, unit assembling quality and income.

Two mathematical models based of production process investigation were designed. The first model was built in simulation programming system eMPlant. It describes material movement in production section. The second model is Petri net designed to verify the first model. The amount of bottlenecks of production process was detected using Petri net. Actions for change of technological route and equipment to reduce to 20% of unit assembling duration were proposed.

The Web-oriented software based on designed models was developed and implemented on Comunar company.

Figure A.6 – Abstract's example in English

APPENDIX B. REQUIREMENTS FOR A LIST OF SOURCES USED

LIST OF SOURCES

1 State Standard GOST 7.1. : 2006 Bibliografichny records bibliografichnyopis. Zagalni vimogi do skladannya rules. – Enter. 01.07.2007.

2 Perroun P. D. Creation of corporate systems based on the Java 2 Enterprise Edition [Text] : hands. Developer : [trans. from English] / Paul J. Perroun, Venkata SR "Krishna" R. Chaganti. – M. [et al.] : Williams, 2001 – 1179 p.

3 Standard 53-2001. Edition. International Standard Book Number [Text]. – Instead of GOST 7.53-86; introduced. 2002-07-01. – Minsk : the inter. Council for Standardization, Metrology and Certification; M. Univ standards, cop. 2002. – 3. – (System of standards on information, librarianship and publishing).

4 Edition. International Standard Book Number [Text] : GOST 7.53-2001. – Instead of GOST 7.53-86; introduced. 2002-07-01. – Minsk : the inter. Council for Standardization, Metrology and Certification; M. Univ standards, cop. 2002. – 3. – (System of standards on information, librarianship and publishing).

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